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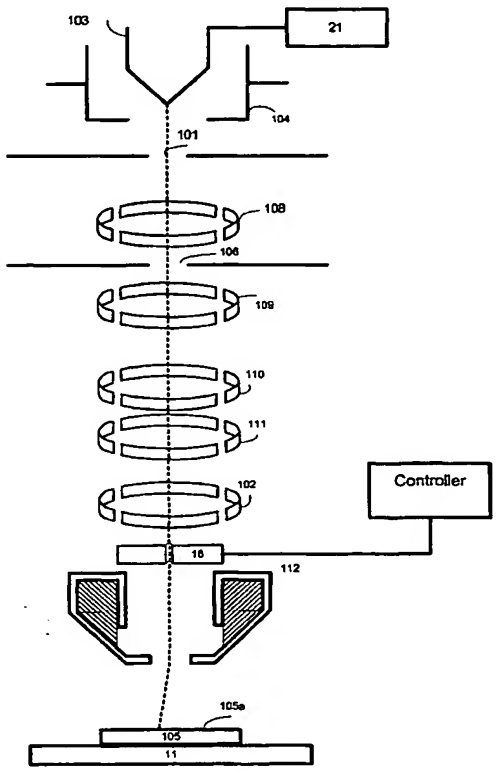
[Continued on next page]

(54) Title: A METHOD FOR MEASURING AND REDUCING ANGULAR DEVIATIONS OF A CHARGED PARTICLE BEAM



(57) Abstract: The invention provides a system and method for determining an angular deviation of a charged particle beam and for calibrating a charged particle beam system that are based upon multiple measurements of a test object that include sidewalls of high sidewall angle uniformity. A path of a charged particle beam is controlled by multiple beam control parameters. The method determines the parameters that will substantially reduce the angular deviation and applies them in order to calibrate a charged particle beam system.

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CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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INTERNATIONAL SEARCH REPORT

PCT/US 03/38140

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01N23/225 H01J37/304

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01N H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/45136 A (ADAMEC PAVEL ; GOLDENSHTEIN ALEX (IL); PEARL ASHER (IL); PETROV IGOR () 21 June 2001 (2001-06-21)	1,3,5,6, 9,12,13, 18, 21-24, 28,29, 33-35, 37-39
	page 5, line 31 - line 35	
Y	page 8, line 9 - line 20; figures 1,2	41,46-50
A	US 6 472 662 B1 (ARCHIE CHARLES NEILL) 29 October 2002 (2002-10-29) cited in the application column 3, line 12 - line 44 column 5, line 21 - column 39	1-39, 51-67

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 August 2004	01 09. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Wulveryck, J-M

Form PCT/ISA/210 (second sheet) (January 2004)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 1 150 327 A (INTEGRATED CIRCUIT TESTING) 31 October 2001 (2001-10-31) column 2, line 53 - column 3, line 10	40,42, 44,45 41,46-50
A	US 6 025 600 A (ROGERS STEVEN R ET AL) 15 February 2000 (2000-02-15) column 3, line 44 - line 55 column 4, line 64 - column 5, line 1	1-39, 51-67
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 458 (E-1596), 25 August 1994 (1994-08-25) & JP 06 150868 A (FUJITSU LTD), 31 May 1994 (1994-05-31) abstract	1-39, 56-67
A	US 6 028 662 A (STURANS MARIS A ET AL) 22 February 2000 (2000-02-22) column 2, line 12 - line 17	1-39, 56-67
A	SOLECKY E ET AL: "Three dimensional top down metrology: a viable alternative to AFM or cross section?" METROLOGY, INSPECTION, AND PROCESS CONTROL FOR MICROLITHOGRAPHY XV, SANTA CLARA, CA, USA, 26 FEB.-1 MARCH 2001, vol. 4344, 2001, pages 366-376, XP001191175 Proceedings of the SPIE - The International Society for Optical Engineering, 2001, SPIE-Int. Soc. Opt. Eng, USA ISSN: 0277-786X the whole document	1-39, 56-67

INTERNATIONAL SEARCH REPORT

PCT/US 03/38140

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-39,51-67

   Method for determining an angular deviation of a charged particle beam

2. claims: 40-50

   Method for calibrating a charged particle beam system

INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/US 03/38140

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